Before the Federal Communications Commission:

In the matter of	(	Docket RM-11829
Amending the Amateur Radio Rules to add a	(	
Tyro License Class, structuring part of the 70cm band,	(	
expanding coordinating committee responsibility,	(	
insuring amateur radio as the primary user of 430-440 MHz,	(	
adding scientific research to the explicit purpose of	(	
amateur radio and requiring governments to allow	(	
amateurs reasonable access to government land to build	(	
and maintain Amateur Radio Community Service	(	
(ARCS) radio systems.	(	

Comments and Further Petition for Rule Making

by Gary A. Hampton

5.1 In the eighteen months since I filed the Tyro Petition, I have met formally and informally with many amateur radio and community service groups. This afforded real benefit. While I stand firm on virtually all of the ideas expressed in the Tyro Petition filed 14 August 2017, these meetings have refined this initiative and I eagerly cede to some very good ideas.

5.2 On the short list of changes is Tyro License issuance. My amateur peers are correct in suggesting the new license should be obtained using the same volunteer examiner (VE) process that is used now. Moreover, there is no need for a minimum age requirement. The VE process itself, will help integrate new recruits into the amateur community with more secure mentor diversity that the, originally suggested, single licensee. Further, the VE process is managed and observed by impartial examiners… examiners more than able to assess recruits for their maturity and readiness, as measured by their understanding of the test questions and the quality of their answers. In short, their calendar age need not be dispositive.

5.3 Next, is a name change. In the original Petition I referred to a portion of the amateur 70cm band to be “re-farmed” as the “Tyro Sub-band.” The better term is: Amateur Radio Community Service (ARCS) Sub-band. This Sub-band is for the use of all amateur licensees… not just the Tyro class. In addition, the Tyro Petition is only part of a much larger amateur radio initiative… a public policy initiative providing the cohesive communications needed by all community service teams **world-wide**.

5.4 Another substantial improvement maturing in the last eighteen months is: digital system control allowing the ARCS Sub-band to be shared using more egalitarian and spectrum efficient ways. I call this "***ad hoc trunking***." *Ad hoc trunking* allows amateur radio clubs to re-farm existing repeaters and cooperatively build new systems… all to be shared by the whole amateur community including the new ARCS volunteers. To users, this sharing technique would seem as if each team had their own system located in an ideal spot serving their immediate local need. This way, radio frequency channels are not reserved for one group or another; what is reserved is an identity code that will collect the selected group on any available repeater. *Ad hoc trunking* allows new ARCS radios to require programming with a call-sign before they transmit. This allows automatic digital identification while they transmit. Anonymous mischief thwarted.

5.5 This addendum to the original Petition asks the Commission to dedicate one duplex pair of ARCS Sub-band channels to a control channel called the: Rendezvous Channel. All repeaters could use the Rendezvous Channel to collect groups onto an appropriate channel for voice or data traffic. All coordinated repeaters must use it. The addendum also changes the channel numbering scheme somewhat. The Rendezvous Channel becomes channel zero, the simplex channels become the lowest numbers and, the repeater channels are the higher numbers through 99. Thus, all channel numbers are displayed using two digits. The complete list is in Appendix A.

5.7 This amended Petition also asks the Commission to amend Part 97.15 to require all local, state and federal agencies to give reasonable access to amateur radio for the construction and operation of ARCS systems. This is intended to mean that: ARCS repeater systems could be built in highway medians, on mountain tops, in parks and any other property owned or controlled by government… as long as such systems would not impede higher priority use.

5.8 Finally, the amended Petition asks the Commission to establish a democratic process electing state (and territory) coordinating committees which will in turn elect a national

committee. Together, these committees will manage the ARCS Sub-band activities including frequency coordination, group identity assignments and open architecture equipment specifications for the *ad hoc trunking* systems to be used for a nation-wide interoperable ARCS Sub-band network.

5.9 Over time, this ARCS Network will extend over every interstate highway, every metropolitan area and will eventually service every hectare of the United States. It can be used for non-pecuniary extant and recreational one-to-many local two-way radio communications among almost any willing persons. It will spawn mass training of radio communicators and technicians advancing the radio art as never before. When millions evacuate before a hurricane, flood, fire or other calamity, among them will be thousands of ARES trained radio communicators. Only the Amateur Radio Service can do this.

5.10 You too can support the ARCS Initiative. The Federal Communications Commission has a wonderful process allowing you to add your voice to your governance. Now is the time.

Learn how to comment by going to: https://www.fcc.gov/consumers/guides/how-comment

Best regards (73),
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SEE ALSO, APPENDIX "A" BELOW.

Appendix "A": Frequency Table & Explanations

The ARCS Sub-band consists of about 2 ¼ MHz of spectrum in the 70cm amateur band. This Sub-band is split into two part: the upper slice is bounded by 438.725-440.000 MHz., the lower slice by 430.0 MHz-431.0 MHz.

This Sub-band is channelized into 100 numbered channels. Ninety-nine (99) are ***traffic-channels.*** One, called the ***Rendezvous Channel,*** is for system control. They are all centered on 12.5 kHz spacing. The modulation is analog FM. When voice it transmitted, a 6dB/octave preemphasis is used. The deviation is limited to plus/minus 2.5 kHz. The *traffic-channel* priority is voice… but, digital data traffic is allowed and even encouraged. The emission designators for the *traffic-channels* are: 11k0F2D, 11k0G2D, 11k0F3E, 11k0G3E, 11k0F9W, 11k0G9W.

The channel numbers and their associated center frequencies:

While the channel numbering is unusual, it is rationalized below.

21 simplex only *traffic-channels*…

for itinerant use anyplace without coordination.
Channel One (***1*** **439.0000** MHz) is the nationwide simplex calling frequency.
If interference is avoided, itinerant repeater output frequencies can be use for simplex (talk-around)… but not on coordinated repeater output frequencies. Simplex is not allowed on repeater inputs.

1 **439.0000,** ***2*** 438.9875, ***3*** 438.9750, ***4*** 438.9625, ***5*** 438.9500, ***6*** 438.9375, ***7*** 438.9250, ***8*** 438.9125, ***9*** 438.9000, ***10*** 438.8875, ***11*** 438.8750, ***12*** 438.8625, ***13*** 438.8500, ***14*** 438.8375, ***15*** 438.8250, ***16*** 438.8125, ***17*** 438.8000, ***18*** 438.7875, ***19*** 438.7750, ***20*** 438.7625, ***21*** 438.7500.

79 duplex pairs are used for repeater channels

Repeater outputs are in the 439 MHz, upper sub-band slice.
Repeater inputs are in the 430 MHz. lower sub-band slice.
The repeater input-to-output split is exactly 9 MHz.

22* .0125, ***23**** .0250, ***24**** .0375, ***25**** .0500, ***30*** .0625, ***31*** .0750, ***32*** .0875,
33 .1000, ***34*** .1125, ***35*** .1250, ***36*** .1375, ***37*** .1500, ***38*** .1625, ***39*** .1750, ***40*** .1875,
41 .2000, ***42*** .2125, ***43*** .2250, ***44*** .2375, ***45*** .2500, ***46*** .2625, ***47*** .2750, ***48*** .2875,
49 .3000, ***50*** .3125, ***51*** .3250, ***52*** .3375, ***53*** .3500, ***54*** .3625, ***55*** .3750, ***56*** .3875,
57 .4000, ***58*** .4125, ***59*** .4250, ***60*** .4375, ***61*** .4500, ***62*** .4625, ***63*** .4750, ***64*** .4875,
#0# ***.5000,*** ***65*** .5125, ***66*** .5250, ***67*** .5375, ***68*** .5500, ***69*** .5625, ***70*** .5750, ***71*** .5875,
72 .6000, ***73*** .6125, ***74*** .6250, ***75*** .6375, ***76*** .6500, ***77*** .6625, ***78*** .6750, ***79*** .6875,
80 .7000, ***81*** .7125, ***82*** .7250, ***83*** .7375, ***84*** .7500, ***85*** .7625, ***86*** .7750, ***87*** .7875,
88 .8000, ***89*** .8125, ***90*** .8250, ***91*** .8375, ***92*** .8500, ***93*** .8625, ***94*** .8750, ***95*** .8875,
96 .9000, ***97*** .9125, ***98*** .9250, ***99*** .9375, ***26**** .9500, ***27**** .9625, ***28**** .9750, ***29**** .9875,

Seventy-eight of these channels (22-99) are intended for both voice and data traffic. One is not.

Repeater channels 30-99 are coordinated for *ad hoc trunking* at fixed locations.

Required ***ad hoc trunking*** may be delayed for two years while technology matures. Due to their proximity to the *Rendezvous Channel*, Traffic-channels 57-72 may be preferred at sites needing very narrow pass-band duplexers.

****Itinerant* repeater channels (22-29) are not coordinated;**

They may be used anyplace for episodic events… often used by, portable "*go-box repeaters*." Itinerant repeaters are not required to support ***ad hoc trunking.***

Ad Hoc Trunking

Ad hoc trunking is a digital scheme controlling one or more repeaters collecting digital collection groups onto assigned repeaters using *Rendezvous Channel* signaling. This is technology being developed by amateur radio itself. The technology will be "open architecture" meaning its protocols are available to the public without royalty or agreements requiring secrecy. The National Coordinating Committee will manage the development of this technology and will manage it after implementation. Any amateur licensee is free to use this technology and manufacture products supporting it. The National Coordinating Committee will manage efficacy testing of products intended for Amateur Radio Service using this technology and may charge for its services. The National Committee may ask state committees to help complete these tasks.

Because of the group collection abilities of *ad hoc trunking* the *UrgentCall* features required starting at section 4.33 of the Petition are not required but could remain a local option. The National Coordinating Committee will select MAYDAY and PAN types of national group collection identities that will replace this feature in Phase-two equipment.

Digital Traffic

The amateur developed *ad hoc trunking* will prescribe a 2400 MSK data protocol that must be used for system control. It can be used for digital traffic too. Yet, to allow flexibility, optional digital modes can be used in the voice channels. Any technique permitted by Part 97 that fits withing the voice channel provided by the 11k0F emission used herein can be used as needed.

#Rendezvous# Channel Zero

While it does more, this system control channel is what its name implies; it arranges meetings among groups of users. These meetings are directed to available *traffic-channels*. The ***Rendezvous Channel*** is the core of ***ad hoc trunking*** technology. All ***phase-two repeaters, mobiles*** and ***base-stations*** use this channel. It is a duplex pair. ***Repeater*** clients (***base/mobiles***) transmit on 430.5000 MHz and all ***repeaters*** transmit on 439.5000 MHz.

The channel is used by ***phase-two*** units to exchange management data, for example: station identity, station location, system status, repeater descriptions, group collection, channel assignments etc. The transmissions on this channel are very brief (usually less than two seconds)… using standardized 2400 baud AFSK/MSK modem-layer protocol and a packetized link-layer protocol. This 2400 MSK modem-layer and packetized link-layer protocol will be developed and maintained under the supervision of the National Committee.

In some respects, ***Rendezvous Channels*** are similar to APRS:

- they are only used for short bursts of data,
- all mobiles, bases and repeaters in the area share the channel (albeit duplex)… using,
- time-division-multiplexing… and,
- it is characterized by interference limited coverage.

But, ***Rendezvous Channels*** are different from APRS:

- they are not digipeaters,
- their data rate is faster,
- their data are transmitted using feed-forward error correction,

- they are not a traffic path to the Internet or among repeater clients,
- its packet structure is tailored for ***ad hoc trunking*** support
  - using repeaters and
  - even simplex.

Sub-audible CTCSS Tone Issues:

Changes in sub-audible tone use described at Section 4.29 & 4.32 are suggested. A forth tone is added, now the list is: Tone A = 67 Hz, Tone B = 79.7 Hz, Tone C = 97.4 Hz and Tone D = 123 Hz.
Tone is only used when the traffic is voice. Digital traffic is transmitted without tone so that receivers can use CTCSS tone decoders to mute receiver speakers during digital transmissions.

Tones A, B and C are used to key repeaters when the traffic is voice. Only these three are required and one of the three must be used to key the repeater when the intended traffic is voice. The tones are coordinated to prevent unintended repeaters from keying on voice traffic intended for another machine.

When the traffic is digital, the packet will identify the repeater intended to carry the traffic. Tone is not useful.

Regardless of which tone is used to key a repeater, all repeater outputs use Tone D when their traffic is voice. Moreover, Tone D is used with simplex voice traffic too. Thus, mobiles and base-stations only need to decode Tone D when the channel traffic is voice. Digital traffic will not contain CTCSS tone.

Further, as a part of the *phase-two ad hoc trunking* protocol, these four CTCSS tones will be phase modulated to transmit limited data along with the voice. This data will include the transmitting station's call sign. The National Committee will specify other uses for this sub-audible data.

Channel numbers are for human interface, mostly...

With trunking, 100 channels are adequate… then, only two-digit displays are needed (00-99). Likely, the lowest channel numbers will be preferred when operating in ***manual-mode;*** that is when the *Rendezvous Channel and ad hoc trunking* is not involved.

Often, this is simplex. So, simplex channels are the lowest numbers… 1 through 21. To be easier to remember, a world-wide simplex calling channel was chosen to be exactly at 439 MHz; it was given channel number **One (1).** Thus, the simplex only channels step to 21 with descending frequencies.

The **Itinerant** repeater channels (22-25 & 26-29) straddle channel 0 at the edges of the duplex slots. Since they probably are at remote locations, they have less need for "tight" duplexers. Yet, they are the most likely for talk-around and ***manual-mode*** use. Thus, the lowest numbers 1-29 are the most likely to be selected by human interaction. While the balance of the repeaters (30-99) will be selected by ***trunking-mode*** controllers**…** where channel numbers are less important.

The R***endezvous Channel*** was assigned number zero,,, it may only be manually selected for test purpose.

Respectfully submitted,

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